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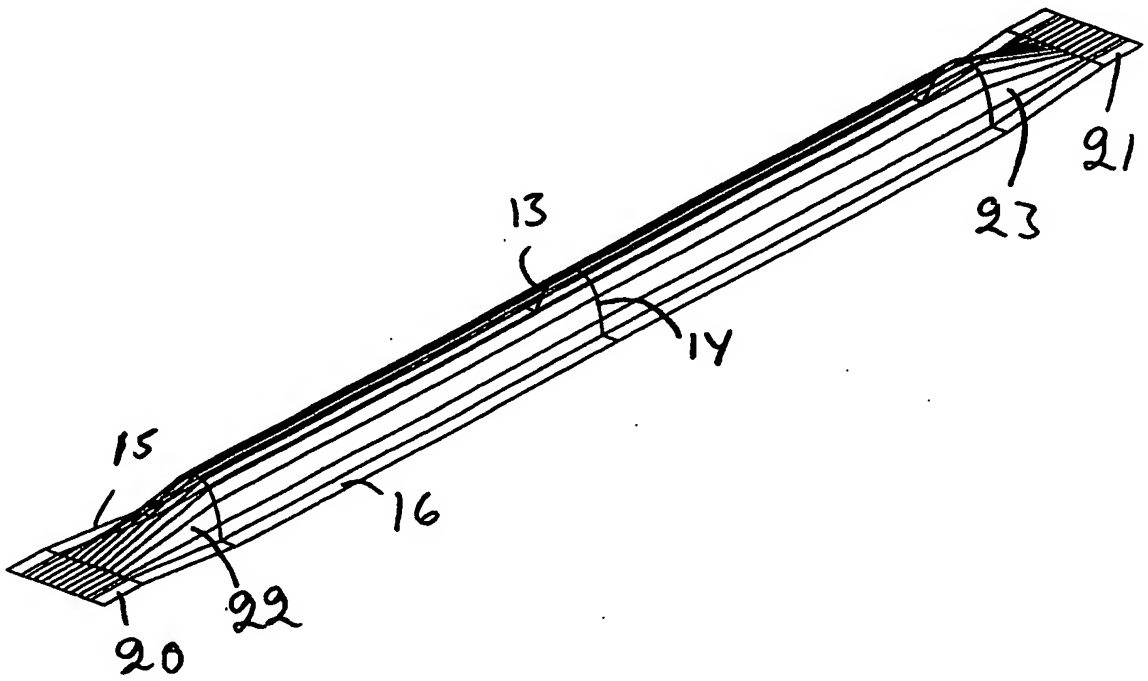
(54) Title: A BEAM FOR A VEHICLE



(57) Abstract

A safety beam for a vehicle, for example a bumper beam or a safety beam in a car door, has the form of a hat beam (11). Its webs or flanks (13, 14) have a form that follows substantially the equation y = cos hyp (x), that is, the form a chain will have when suspended at its two ends. As a result of this flank form of the beams, the flanks will not be subjected to any forces transverse to them until they begin to deform when subjected to an external load in a collision. The beam can therefore take up greater forces before being deformed

A beam for a vehicle

Field of invention

This invention relates to a beam for a vehicle and in particular it relates to a safety beam. Safety beam are used for example as side impact beams or bumper beams in automotive vehicles. Today, one strives to make motor vehicles and especially passenger cars as light in weight as possible, and the safety beams should therefore be as light in weight as possible and still meet the demand for increased energy absorption capacity.

Object of invention and brief description of the invention

It is an object of the invention to provide safety beams that are light in weight and have a high energy absorption capacity.

This object is fulfilled in principle in that the two flanks of the beam has a form in cross section that follows the equation y = cos hyp (x) and the invention has been given the characteristics defined in the claims.

This form of flanks is the form of a free-hanging chain suspended at its ends only. With this form of the flanks, there will be no transverse forces on the flanks when there is a load on the beam, but all forces are in the bent plane of the flanks. The beam will therefore withstand greater forces than corresponding conventional beams before its deformation begins and the beam will also absorb more energy than corresponding beams with other flank forms.

The two flanks can meet directly, or alternatively, there can be a central part between the flanks. The flanks can suitably end in side flanges and the side flanges can be coupled together by means of a plurality of coupling elements that can be strips of sheet steel spot welded to the flanges or attached to them in any other way.

Alternatively, a coupling element in the form of a sheet steel cover can be attached to the flanges to give the beam a closed profile. A closed profile can also be achieved by the hydroforming of a closed blank. The beam can be symmetric or asymmetric and its height and width may vary along its length.

Brief description of the drawings and description of preferred embodiments

Figure 1 is a transparent perspective view of the left half of a bumper beam for a front bumper.

Figure 2 is a section through the bumper beam shown in Figure 1.

Figure 3 is a transparent perspective view of a safety beam for an automobile door.

Figure 4 is a transparent perspective view of the bumper beam of a front bumper and part of the side beams of an automobile.

Figure 5 is a transparent perspective view of another bumper beam.

Figure 6 is a section through a bumper with a bumper beam of the kind shown in Figure 4, but not exactly the same one as in Figure 4.

Figure 7 is a section through a bumper with one more example of a bumper beam of the kind shown in Figure 4.

Figure 8 is a section through a bumper with a bumper beam of the kind shown in Figure 5, but not exactly the one in Figure 5.

Figure 9 is a section through a beam of the kind shown in Figure 3, but it is doubled.

In the figures, corresponding elements have the same reference numerals.

Figures 1 and 2 show the left half of a bow-formed beam for a front bumper. The beam is symmetric both lengthwise and crosswise. It comprises a hat beam 11 with a cover 12. The hat beam 11 has two flanks or webs 13,14 that meet in the centre line of the beam, and the flanks end in side flanges 15, 16 with upstanding edges 17, 18. The cover 12 is fixed to the flanges 15, 16 preferably by spot welding. The cover 12 can be flat but it is shown having stiffening grooves and creases.

The two flanks 13,14 have a cross sectional form that corresponds to the equation $y = k \cdot \cos \text{hyp}\,(x)$, that is, $y = k \cdot \frac{e^{x} + e^{-x}}{2}$ in which k is a scale factor. The two flanks 13, 14 will together have the form of a free-hanging chain suspended at its two ends only, and all forces will therefore be in the bent plane of the flanks when the beam is subject to a symmetrical load. Thus, there will be no forces transverse to the flanks, and the beam will therefore withstand greater forces than corresponding beams with other flank forms before the deformation starts. The beam will also absorb more energy during deformation than corresponding beams with other flank forms.

Figure 3 shows an open hat beam intended for use as a side impact beam in a door of a passenger car. It has a central section comprising two flanks 13, 14 with the form of a chain described above and two side flanges 15, 16. It has mounting sections in the form of flat end portions 20, 21 and transition sections 22, 23 between the central section and the end portions. The central section has a constant cross section over its length. Alternatively, it may have a constant height but continuously varying width along its length, which means that the scale factor k varies in the equation above. In the same way, a beam may have a constant width and varying height and still, the flanks can have this form of a chain along their length. Both the height and the width may also vary. The beam 11 may be symmetric or asym-metric lengthwise. The hat beam 11 is primarily intended to be mounted with its top outwardly directed so that the top of it will be hit in a collision.

Figure 4 shows a bow-formed bumper beam in the form of a hat beam 11 fastened to the side beams 30, 31 of an automobile. The beam is shown as an open profile, but it may also have a cover like the beam in the figures 1 and 2. The two flanks of the beam 11 has the same chain form as the flanks of the beams in figures 1 and 2 and the flanks of the beam in figure 3. The two flanks do not meet directly but they are separated by a central part as will be described later with reference to figure 6.

The bumper beam 11 takes support against the vertical sides of the side beams 30, 31 and the horizontal parts of the side beams extend as flaps along the flanks of the bumper beam 11 and have been fixed to them by spot welding. The vertical sides of the side beams 30, 31 may have outwardly bent ends that have been fixed to the top of the beam by spot welding. The ends of the hat beam may have continuously decreasing height as shown so that the side beams of the vehicle can be somewhat longer, which improves the energy absorption capacity of the side beams more than it reduces the energy absorption capacity of the bumper beam. The flanks of the bumper beam may maintain their form all the way to their ends but their ends may have a different design.

Figure 5 shows another bumper beam 11 in accordance with the invention. It has its top directed outwardly and a plurality of sheet steel strips 35 that couple the flanges 15, 16 together as an alternative to a complete cover of the kind shown in figures 1 and 2. The strips 35 are fixed to the flanges 15, 16 by being welded thereto, suitably by spot welding.

Figure 6 is a transverse section through a bumper beam of the kind shown in Figure 4. It comprises a hat beam 11 with two flanks 13, 14 that end in side flanges 15, 16 with upwardly bent edges 17, 18. A cover 12 is spot welded to the flanges 15, 16. The two flanks 13, 14 have the described form of a free hanging chain and they are separated by an intermediate part 36. An energy absorbent in the form of a stiff foam, for example a polyurethane foam, is attached to the cover 12 by being cemented thereto and the foam and the bumper beam form together the bumper. The bumper is to be mounted with the foam outwardly directed.

Figure 7 shows a bumper slightly modified from the one on Figure 6. The difference is that the cover 12 has the form of a hat beam and extends into the hat beam 11.

Figure 8 shows in a transverse section a bumper beam of the kind shown in Figure 5, namely a beam which has its top outwardly directed and its cover adjacent the vehicle. The foam 37 is attached to the top of the hat beam, that is, attached to the intermediate part 36.

Any beam of the kind described can be multiplied as shown in Figure 9. In this Figure, two beams of the kind shown in Figure 3 are integrated and they have one of their side flanges, flange 40, in common.

Claims

1 A beam for a vehicle,
characterised in that, at least along a major part of its length, the beam comprises two flanks (13, 14) with a form in cross section that follows substantially the equation $y = k \cdot \cos \text{hyp}(x)$.

2 A beam according to claim 1,
characterised in that the two flanks (13, 14) meet directly.

3 A beam according to claim 1,
characterised by a central portion (36) between the two flanks (13, 14).

4 A beam according to any one of the preceding claims,
characterised in that the flanks (13, 14) end with side flanges (15, 16).

5 A beam according to claim 4,
characterised in that the side flanges (15, 16) have upstanding edges (17, 18).

6 A beam according to any one of the preceding claims,
characterised in that it has a closed cross section.

7 A beam according to claim 4 or 5,
characterised by elements (12, 35) coupling the two side flanges (15, 16) together.

8 A beam according to claim 7,
characterised in that said coupling elements comprises a plate (12) that gives the beam a closed cross section.

9 A beam according to any one of the preceding claims,

characterised in that it is made of stamped and hardened steel sheet.

10. The use of a safety beam according to any one of claims 1 - 5 as a side impact beam in an automotive vehicle, the beam having an open cross section and its top directed outwardly.

FIG 1

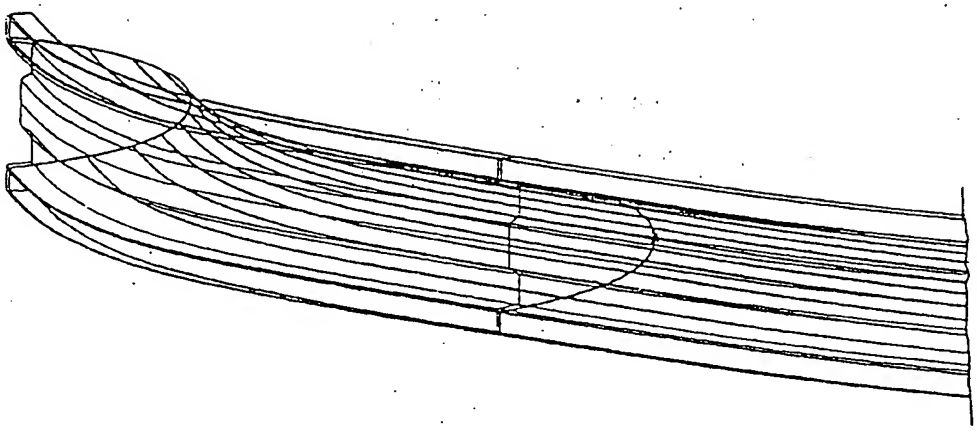


FIG 2

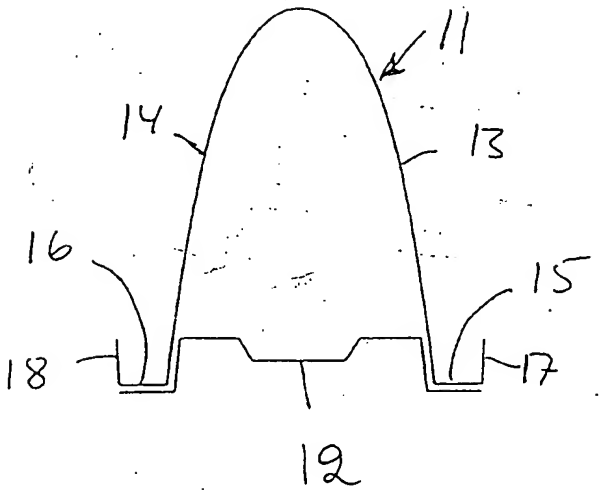


FIG 3

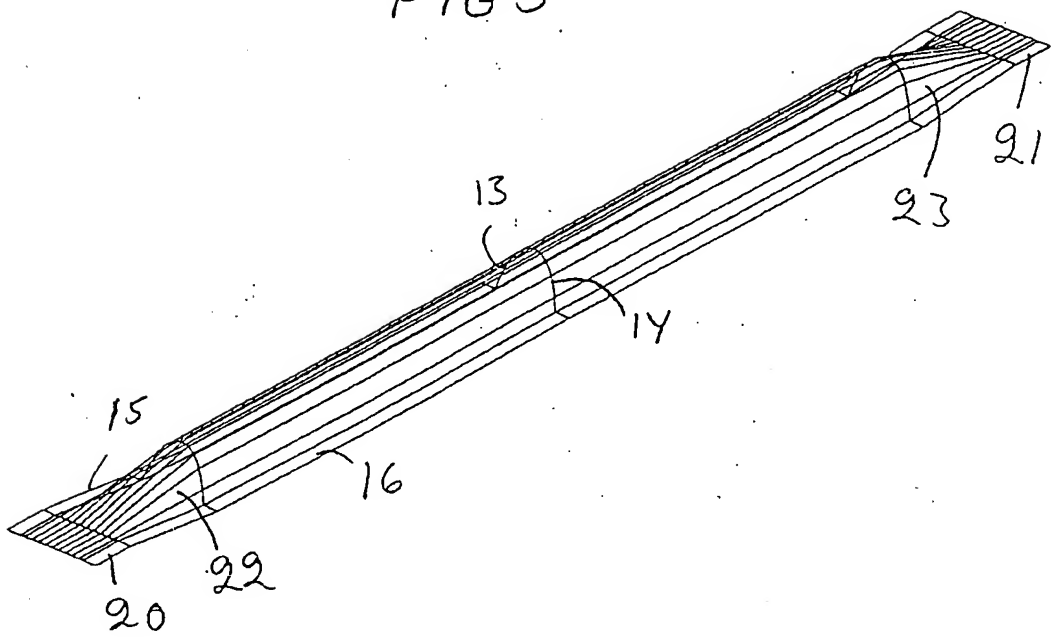
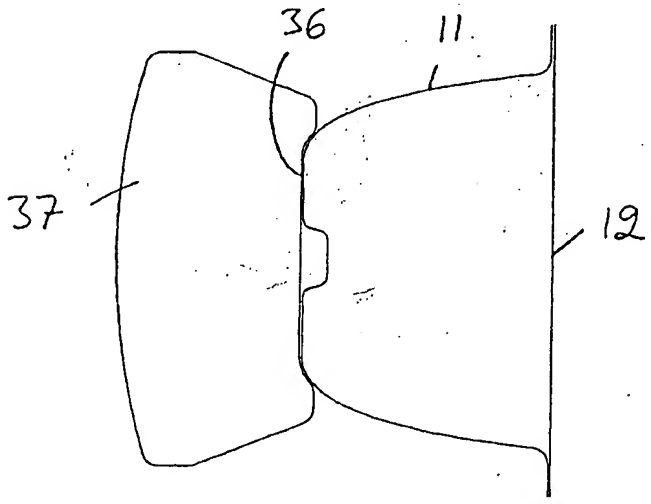


FIG 8



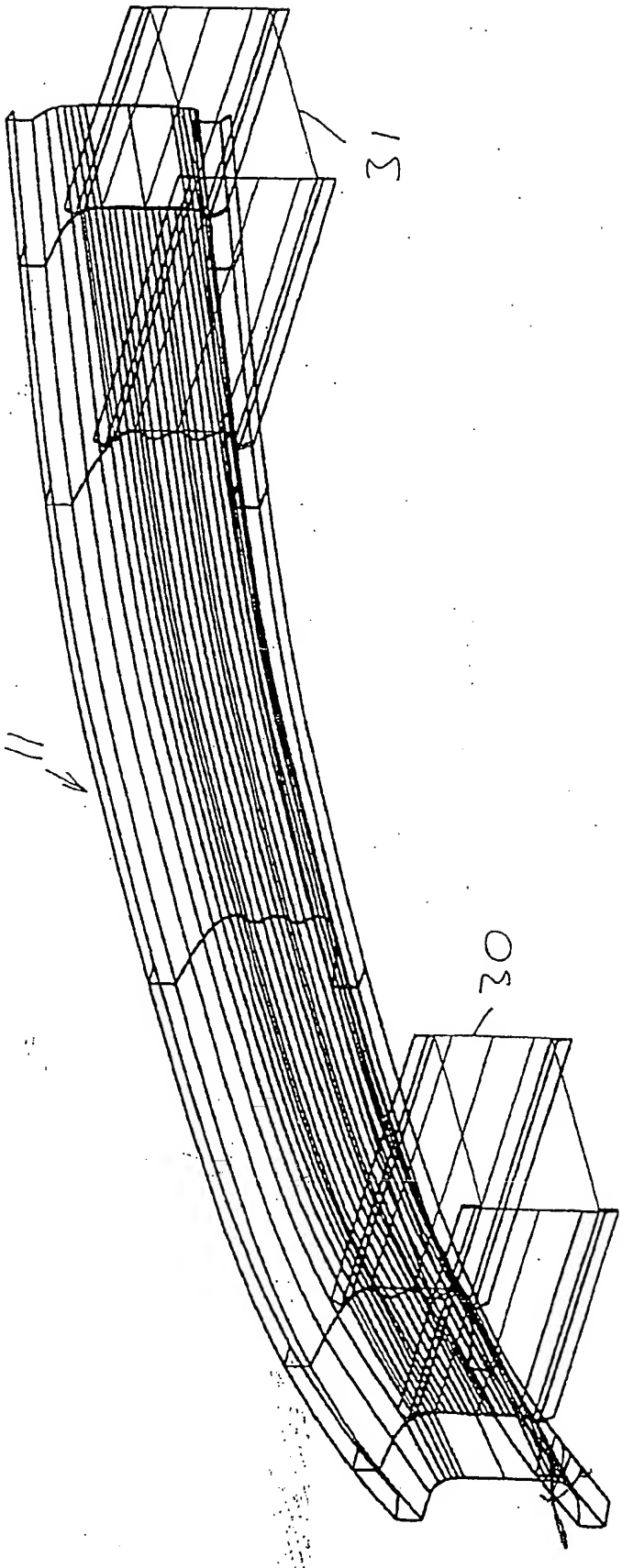


FIG 4

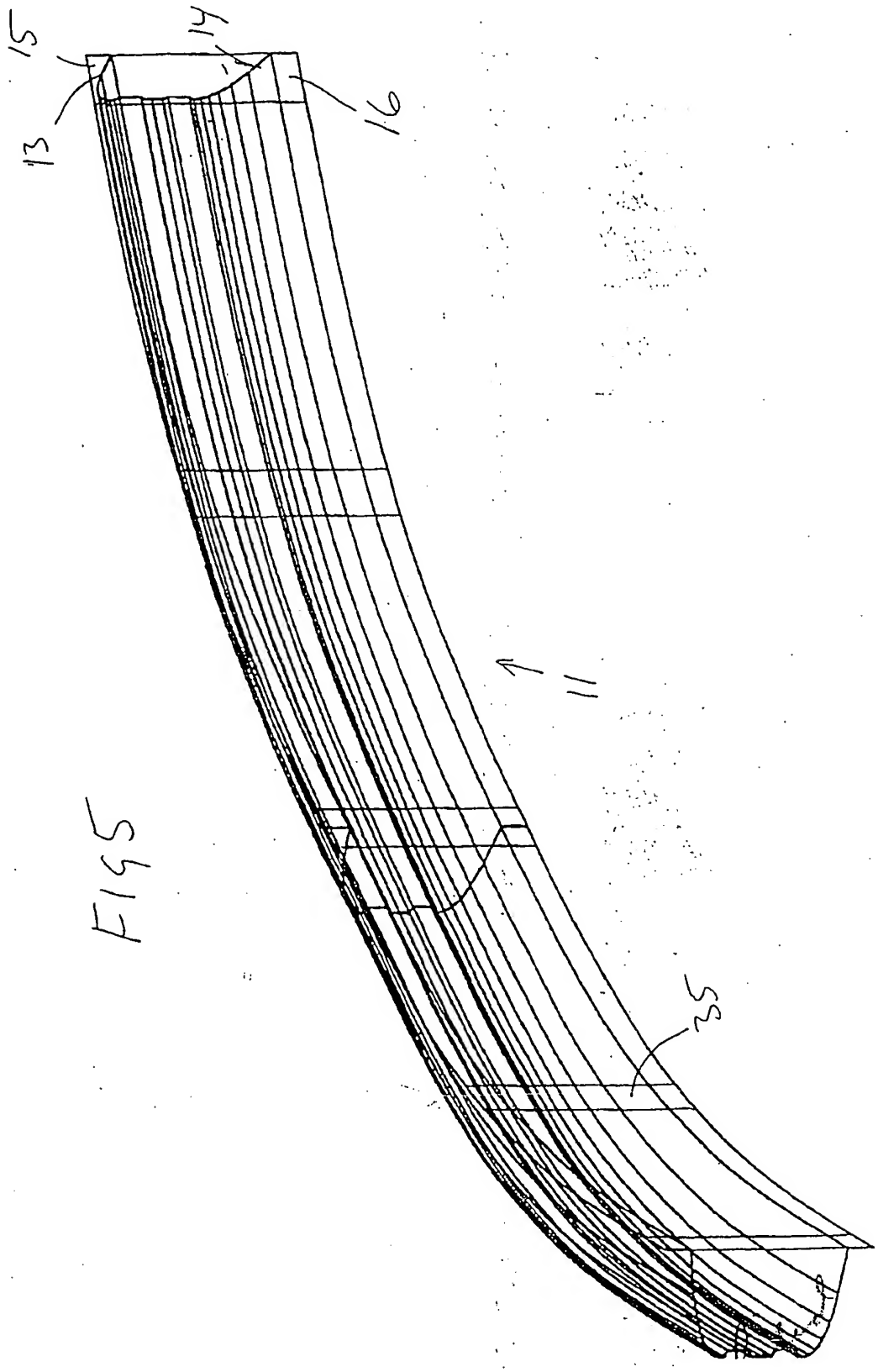


Fig 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/01870

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B60R 19/02, B60J 5/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B60R, B60J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 19610143 A1 (HAUG, WOLFRAM), 18 Sept 1997 (18.09.97) --	1-10
A	US 5080410 A (STEWART ET AL), 14 January 1992 (14.01.92) --	1-10
A	WO 9520506 A1 (PLANNJA HARDTECH AB), 3 August 1995 (03.08.95) --	1-10
A	WO 9407709 A1 (PLANNJA HARDTECH AB), 14 April 1994 (14.04.94) --	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 February 1999	18 -02- 1999
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM	Authorized officer Hans Nordström

INTERNATIONAL SEARCH REPORT

Information on patent family members

21/12/98

International application No.
PCT/SE 98/01870

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